IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

NORTHWEST ENVIRONMENTAL DEFENSE CENTER, WILDEARTH GUARDIANS, and NATIVE FISH SOCIETY,

Plaintiffs,

v.

UNITED STATES ARMY CORPS OF ENGINEERS and NATIONAL MARINE FISHERIES SERVICE,

Defendants.

CITY OF SALEM and MARION COUNTY,

Intervenor-Defendants.

No. 3:18-cv-00437-HZ

ORDER

HERNÁNDEZ, District Judge:

Before the Court are the Expert Panel's proposed implementation plans for Foster spring downstream passage operations (injunction action 13(b), Cougar spring downstream passage operations (injunction action 15(a), and Fall Creek winter and spring downstream passage

operations (injunction action 20)). Notice, ECF 224; Interim Injunction, ECF 212. No objections to the Panel's proposals have been filed.

Having considered the Expert Panel's comprehensive implementation proposals, the Court amends Interim Injunction actions 13(b), 15(a), and 20 as follows:

(13) Beginning fall 2021, the Corps SHALL carry out fall and spring fish-passage operations at Foster Dam.

* * * *

(b) The Corps SHALL carry out spring passage operations at Foster Dam as specified in the Expert Panel's Foster Dam Spring Spill Injunction Measure.[1]

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(15) Beginning in 2022, the Corps SHALL carry out spring passage operations at Cougar Dam as specified in the Expert Panel's Cougar Spring Fish Passage Injunction Measure.[2]

* * * *

(20) Beginning in 2022, the Corps SHALL conduct winter and spring passage operations at Fall Creek Dam as specified in the Expert Panel's Fall Creek Dam and Reservoir Delayed Refill Measure.[3]

IT IS SO ORDERED

DATED: November 2, 2021.

Marco Hernández

MARCO A. HERNÁNDEZ
United States District Judge

[1] Included as Attachment 1 to this Order, ECF 227.
[2] Included as Attachment 2 to this Order.
[3] Included as Attachment 3 to this Order.

ATTACHMENT 1

Foster Dam Spring Spill Injunction Measure
2021-10-15

Description/Intent

On September 1, 2021, the U.S. District Court for the District of Oregon issued a final Interim Injunction Order that directs the Corps to implement specified operations intended to improve conditions for fish passage and water quality in the Willamette Valley Project (WVP) to avoid irreparable harm to Endangered Species Act (ESA) - listed salmonids during the interim period until the completion of the reinitiated ESA consultation. These measures must be carried out "to the greatest extent practicable under existing hydrologic conditions and necessary flood control operations" while making "every effort to comply with the various water temperature, Total Dissolved Gas (TDG) and instream flow requirements governing WVP."

As required by the Order, the Corps will conduct/prioritize spillway operations at Foster Dam during the spring for juvenile fish passage, beginning in the spring of 2022.

The Court assigned an Expert Panel comprised of two of Plaintiffs' experts, two NMFS biologists, two Corps employees, and two "ad hoc" Federal experts to define the details of this and other measures that will be incorporated into a final Interim Injunction Order, with which the Corps must comply. The Expert Panel Assignment for the Foster spill operation is to "Consider and propose measures specifying the dates, hours, and amount of turbine use for the Foster spill operations that will provide the most benefit to the listed salmonids as a whole. The Experts will also consider and make a recommendation on whether delayed spring refill should be implemented."

The Federal Agencies have taken the initiative to develop a proposed plan for consideration by the Expert Panel that ensures the measure is both successful and timely. When developing and planning for the implementation of any operational change, multiple factors must be considered.

- First, what is/are the biological objective(s) or goal(s) being sought and how can these objectives best be achieved?
- Second, what are the constraints or factors that need to be considered?
- And third, what additional information should be considered when shaping the operation?

Biological Goal

The goal of this spill operation measure is to provide improved downstream fish passage and survival for juvenile spring Chinook salmon and steelhead through Foster Reservoir and past Foster Dam. Through biological studies (or Research, Monitoring and Evaluation, RM&E) over the last several years, regional biologists have learned that juvenile Chinook salmon mostly enter Foster Reservoir during the winter and early spring, peaking in February and March, while steelhead juveniles enter the reservoir in all months but mostly between July and November. When passing Foster Dam, both species tend to:

- Exit Foster Reservoir mostly at night.
- Pass in higher numbers via the spillway compared to the turbines.
- Survive at greater numbers when passed through the spillway than through the powerhouse and turbines.

Several years of RM&E of downstream fish passage timing and distribution indicate juvenile salmon and steelhead spring outmigration in the South Santiam River generally occurs from March through early June (Hughes et al 2016, 2017; Monzyk et al 2017; Romer et al 2016), with 96-98% Chinook salmon and steelhead passing Foster Dam at night and very few fish pass during daylight hours (Hughes et al 2016, 2017; Liss et al 2020). Additionally, approximately 58% of fish pass the spillway compared to 20% passage through the turbines, and survival rates were higher at the spillway (68%) compared to the turbines (57%) (Hughes et al 2016, 2017; Liss et al 2020).

Research conducted during 2016 through 2017 to evaluate the influence of Foster operations (turbine and spill) on TDG levels on river environment and fish habitat downstream of the dam indicate TDG levels in the river were highest (exceeding 110%) during periods when the spillway was operated by itself (i.e., with no turbine operation) (Arntzen et al 2018). However, TDG levels decreased (less than 110%) during periods of spillway and turbine operations (turbines were operated at 200 cfs for Station Service only) (Arntzen et al 2018). The TDG levels, even when they exceeded 110% saturation for short durations, did not appear to affect adult and juvenile salmon in the river (Arntzen et al 2018).

The proposed timing of the spring spill operation is based on research (RM&E) conducted to evaluated downstream fish passage and downstream TDG levels at Foster Dam.

Spring Spill Operation dates: February 01 through June 15.

Spring spill should be carried out from February 01 through June 15 through the operation of the spillway at night for downstream fish passage. Spillway bays 3 or 4 are preferred for this spill operation because of their location (nearest to) from turbines and will provide consistent attraction to that area. However, any of the spillway bays may be used and the actual spillway bay operation may be determined by Foster Operators to cycle the spillbays as necessary. Additional spill bays may be operated depending on flow conditions and water management needs.

This measure will be carried out with three operations:

1) <u>February 01 – May 15:</u> Delay the refill of Foster Reservoir and hold elevations at minimum conservation pool (El. 613 ft.). Operate the spillway during the night, from one hour before sunset to one-half hour after sunrise; turbine unit 1 (only) will be operated at station service (~300 cfs) to reduce/balance TDG levels created by the spill operation. Spill gates should be opened to at least a 1 ft. gate opening; outflow amounts will be dictated by reservoir elevation. Flows will be spread across multiple gates if necessary[1]. The fish ladder will continue to be operated. During the day, the Foster turbine units will be operated from one-half hour after sunrise to one hour before sunset, with full generation. The spillway will not be used to discharge water during this time unless required for flood risk management. The fish ladder will continue to be operated. During high flow events, this operation will be modified to carry out flood risk reduction measures. Spill may also be reduced to prevent downstream Total Dissolved Gas violations to the State Water Quality Standard of 110%.

[1] Spreading spill across multiple gates reduces TDG generation. However, spillway passage survival tends to be highest at higher gate openings. These and other issues associated with spill operations were considered in developing this plan.

The BiOp maximum outflow from March 16 – May 15 is 3,000 cfs. Under high flow events, outflows that exceed this maximum level may be necessary to hold Foster Reservoir at minimum conservation pool elevation. Since observations suggest that there are few fish spawning in the mainstem, the biological risk to outflows in excess of 3,000 cfs is considered minimal. Holding Foster Reservoir at minimum conservation pool from February 01 – May 15 therefore takes priority over holding outflows below the 3,000 cfs maximum.

2) May 16 - June 15: Refill Foster Reservoir by using storage from Green Peter Reservoir and South Santiam inflow. Green Peter maximum conservation pool elevation (El. 1010 ft.) provides storage from the reservoir to refill Foster in mid-May and supports Green Peter spring spill operation using the spillway. This requires balancing the BiOp targets and power pool use. Target full pool at Foster Reservoir by Memorial Day Weekend. Operate the spillway during the night, from one hour before sunset to one-half hour after sunrise; turbine unit 1 (only) will be operated at station service (~300 cfs) to reduce/balance TDG levels created by the spill operation. Spill gates should be opened to at least a 1 ft. gate opening; outflow amounts will be dictated by reservoir elevation (Table 1). Flows will be spread across multiple gates if necessary. The fish ladder will continue to be operated. During the day, the Foster turbine units will be operated from one-half hour after sunrise to one hour before sunset, with full generation. The spillway will not be used to discharge water during this time unless required for flood risk management. The fish ladder will continue to be operated. During high flow events, this operation will be modified to carry out flood risk reduction measures. Spill may also be reduced to prevent downstream Total Dissolved Gas violations to the State Water Quality Standard of 110%.

3) June 16 – mid to late July: Operate the Foster fish weir for downstream water temperature management to improve adult Chinook salmon attraction and collection at the Adult Fish Facility. The Fish Weir would be operated at a 300 cfs flow through spillbay 4 from June 16 - July 31, 2021 (or earlier, depending on storage, water availability and biological need). Close coordination with the Flow Management & Water Quality Team (FMWQT) and the Foster Fish Facility manager will be necessary to adaptively manage this operation.

Capacity per Turbine at Min Pool (cfs): 1,710
Capacity per Turbine at Max Pool (cfs): 1,330
Total Cap. at Full Load at Min Pool (cfs): 3,420
Total Cap. at Full Load at Max Pool (cfs): 2,660

Total project outflow and refill capabilities will depend on project storage and water availability. The minimum BiOp flows for Foster Dam is 800 cfs from February 01 - March 15, 1500 cfs from March 16 – May 15 and 1100 from May 16 – June 30. In dry years, minimum BiOp flows may need to be reduced; adaptive management will be necessary and will be discussed between the Corps and NMFS.

The Corps' TDG model for Foster Dam predicts that spillway flows in excess of 3,000 cfs will generate TDG that exceeds the 110% water quality standard. This, and other water quality conditions will be monitored, and flows will be adjusted accordingly throughout this fish passage operation to ensure that State water quality standards are not violated.

Table 1. Foster Dam Spillway Rating Table, 1 ft. Gate Opening.

Elevation, in ft. NGVD29	Flow at a 1ft. Gate Opening, in cfs
615	910
620	1020
625	1110
630	1210
635	1290
637	1320

Constraints and Considerations

This plan considers both the constraints that must not be violated, as well as other considerations such as current hydrologic conditions, etc. While implementing the spring spill operation at Foster Dam, the following constraints must be adhered to at all times:

a. The BiOp minimum flow targets for salmon and steelhead spawning and incubation downstream of Foster Dam is 800 cfs from February 01 - March 15, 1500 cfs from March 16 -May 15, and 1100 cfs from May 16 -June 30. During low flow years, if necessary, there will be Flow Team recommendations to balance the spawning for Chinook and steelhead, with use of available power pool volume in the fall season.
b. In general, spillway operations are known to produce total dissolved gas (TDG) in exceedance of 110%. However, RM&E indicates operating turbine unit 1 at Station Service will reduce/balance TDG levels in the tailrace and downstream of Foster Dam during this fish passage operation. If higher outflows are required due to high inflow events, spill operations can be increased to as much as 3,000 cfs; higher spillway releases should be avoided to keep TDG levels downstream of Foster Dam below 110%.
c. The spillway gates should not be operated at less than 1 foot open.
d. The Corps' flood control mission is prioritized over all other actions and at no time will human health or safety be jeopardized during the implementation of this measure.

In addition to the constraints, the following considerations were used to develop the Foster Spill operations implementation plan:

a. Fish passage through Foster Dam occurs at night with few, if any, fish pass during daylight hours.
b. The Foster Adult Fish Facility is typically operated from February through November. The side entrance of the fishway (ladder) is adjacent to the spillway and spill could attract adult fish to the spillway instead of the ladder entrance. Additional flow to the ladder area may reduce this problem.
c. Larger spillway gate openings generally provide safer passage. This should be taken into consideration.
d. Use of Green Peter power pool storage to meet downstream flow benefits was coordinated through the Flow Management and Water Quality Team (FMWQT) when drought conditions were recognized early.

Implementation Plan

Taking the biological goal, RM&E conducted to date, constraints, and considerations described above into account, this implementation plan has been developed for the Foster Dam spring spill operation Injunction Measure, with the spill operation commencing with a delayed refill on February 01, 2022. Note, the spill operation is tied to the hydrologic conditions of each year; that is, the total flow amount and timing (dates) of the start and end of the spill operations each season and year. These conditions could change depending on hydrologic conditions (water availability). What will not change from year to year is the overall goal of the operation and the constraints, which is to operate the spillway in the fall for downstream fish passage.

Potential Impacts and Mitigation

Spillway operations can create high TDG levels downstream of Foster Dam; that is TDG levels that violate the State water quality standard of 110%. Therefore, it is imperative to operate one turbine unit (Unit 1) at Station Service during spill operations to reduce/balance the TDG levels downstream of the dam.

Per Dam Safety requirements: Spill should be split evenly between two spill bays (e.g., bays 3 and 4) as long as a minimum gate opening of 1.0 foot can be obtained for each bay. If a 1-foot opening cannot be maintained using two bays, a single spill bay will be used, alternating daily between bays 2, 3, and 4. Spill bays 2-4 should be used for passing flows above 4,000 cfs through the spillway. All spill bays would be used for passing flows above 12,000 cfs.

This measure does not require additional NEPA analysis.

Biological Monitoring

The goal of the RM&E is to learn as much as possible from this downstream fish passage operation to inform the success of this operation or any changes/adjustments to the operation in future years. A primary objective of the delayed refill operation is to provide conditions for volitional passage of juvenile Chinook (especially fry) as well as winter steelhead. The metrics of interest include juvenile Chinook salmon and steelhead passage timing, forebay behavior and distribution, route distribution, passage rates and passage survival. However, the capability of evaluating this and other operations at Foster Dam is extremely limited because infrastructure to implement a monitoring study is inadequate or nonexistent in the South Santiam watershed; e.g., no means to sample juvenile fish below or in the spillway, no PIT tag detection capabilities. Therefore, development of monitoring infrastructure will be a high priority when a long-term RM&E plan is developed so that the effectiveness of operations at Foster and Green Peter dams can be evaluated.

If possible, operate a rotary screw trap upstream of the reservoir following methods of Romer et al. 2017 and Monzyk et al. 2017, including estimation of trap efficiency. Data collected would include timing, numbers, and size of migrants. When a contract is in place and conditions allow, PIT tag antennas will be installed on the Foster Dam fish weir to monitor downstream migration as was done in 2014 (Monzyk et al. 2017).

It is not feasible to use screw traps in the tailrace of Foster Dam because the river environment is shallow. There is only one potential location for a screw trap in the tailrace, which is directly downstream of the powerhouse (turbine unit 1), close to the shore. Oregon Department of Fish and Wildlife operated a screw trap downstream of the turbine, close to shore, during 2015 and 2016 and determined the trap efficiency was very poor and removed the screw trap from operation (Romer et al 2016). Because a rotary screw trap cannot be operated downstream of Foster Dam below the spillways, alternative sampling methods should be investigated in order to adequately assess the effectiveness of passage measures at Foster and Green Peter dams. Alternative methods might include a sampler designed to work within the spillway or a surface flow collector just upstream of the spillway entrance.

- The Expert Panel will develop a long-term RM&E strategy for the South Santiam River by December 31, 2021, including a plan for site-specific passage and survival and a plan for developing and implementing detection infrastructure for conducting studies using large release groups (e.g., detection at Foster and Lebanon dams). A study similar to that of Monzyk et al. 2017 should be incorporated into the long-term RM&E plan to capture and PIT tag juvenile O. mykiss in the South Santiam River and spawning tributaries upstream of the reservoir, as well as in a rotary screw trap. Methods of Monzyk et al. 2017 should be reviewed to determine if changes in study design are needed, such as sample size, time and duration of sampling, location of sampling, location of screw trap, etc.

- RME for Spring 2022 is not contingent upon the completion of the December 31 long term RM&E strategy. Funding and planning for Spring 2022 RM&E at Foster Dam should take place immediately.

- Surrogate fish (hatchery fish raised to mimic the size of fish likely to pass Foster Dam) will be needed to conduct studies requiring releases of large numbers of fish (e.g., outmigration and survival), not just for Foster studies but also for Green Peter passage studies. The Corps will have eggs collected from returning Chinook adults during fall 2021 and have them raised to the sizes needed to conduct passage survival studies using surrogate fish in 2022.[2]

Active tags will be used to evaluate the downstream fish passage operation in the Spring using surrogate fish.

- 2022 and beyond:

Route distribution	Active tag study
Passage timing	Active tag study
Passage rate	Active tag study/PIT tag
Passage survival	Active tag study/PIT tag
Project survival	Active tag study/PIT tag

*Survival studies may require the need to tag and release surrogate fish.

[2] Surrogate two-year old winter steelhead will not be available in 2023 although one-year old winter steelhead may; eggs were not collected in 2021 due to low populations of returning adults.

Dam Safety

A similar operation has been implemented at Foster Dam since 2019 and in general, there are no major dam safety concerns from the implementation of this measure. Some historical stilling basin erosion has occurred over time, however flows associated with this operation are small and less than what would trigger a stilling basin inspection.

Minimum gate openings will be observed to avoid gate vibrations.

Irrigation Impacts

There is approximately 754 acre-feet of storage water currently under contract for irrigation use downstream of Foster Dam with water being diverted from various locations along the South Santiam River. Irrigation water users can divert up to the 754 acre-feet of storage water during the irrigation season from April 1 – October 31. Actions that substantially reduce summer storage or releases could affect irrigation water service contractors and water rights.

Hydropower Impacts

BPA expects hydropower impacts to be similar to past Foster Fall Spill operations.

Transmission Impacts

BPA expects hydropower impacts to be similar to past Foster Fall Spill operations.

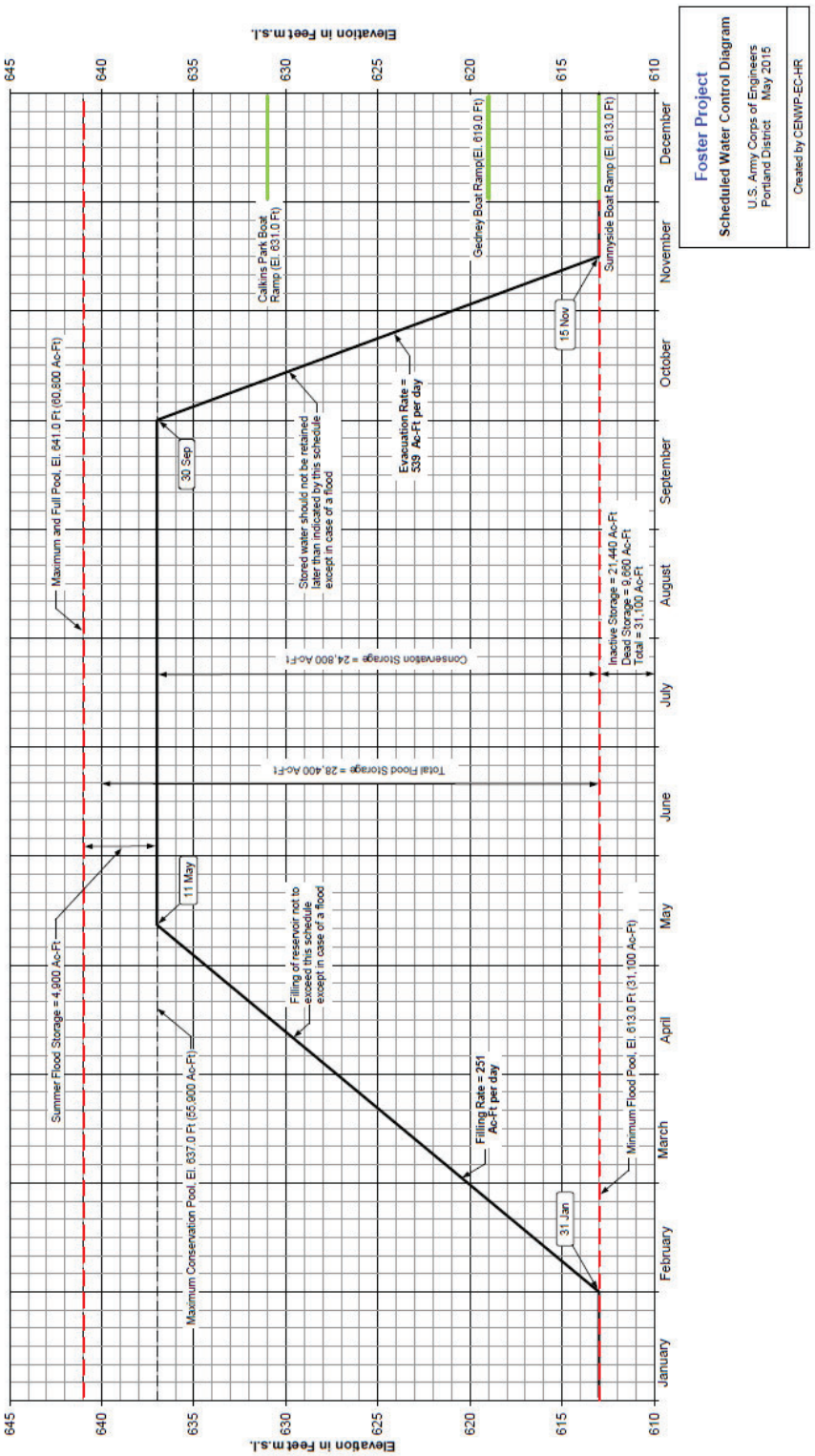

Figure 1. Foster Reservoir Water Control Diagram

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ATTACHMENT 2

Cougar Spring Fish Passage Injunction Measure
2021-10-14

Description/Intent

On September 1, 2021, the U.S. District Court for the District of Oregon issued an Interim Injunction that directs the Corps to implement interim injunction measures intended to improve conditions for fish passage and water quality in the Willamette Valley Project (WVP) to avoid irreparable harm to Endangered Species Act (ESA) - listed salmonids during the interim period until the completion of the reinitiated consultation. These measures must be carried out "to the greatest extent practicable under existing hydrologic conditions and necessary flood control operations" while making "every effort to comply with the various water quality standards governing the WVP."

As required by the Order, beginning in 2022, the Corps shall conduct spring passage measures at Cougar Dam. Specifically, the measure should "consider spring passage at Cougar Dam, including delayed refill measures, and propose operational measures that prioritize volitional downstream fish passage via non-turbine routes." The Court assigned an Expert Panel comprised of two of Plaintiffs' experts, two NMFS biologists, one Corps engineer, and two "ad hoc" Federal experts to define the details of this and other measures that will be incorporated into the final Interim Injunction Order, with which the Corps must comply.

The Expert Panel, assisted by the Federal Agencies' Internal Technical Team (ITT), has developed this implementation plan considering multiple factors:

- First, what is/are the biological needs being sought and how can these needs best be achieved?
- Second, what are the constraints or factors that need to be considered?
- Third, what additional information should be considered when shaping the operation?

Biological Need

The need for this measure is to provide safe and timely passage for outmigrating juvenile spring Chinook by delaying refill and providing passage through the dam's regulating outlet. Through biological studies (or Research, Monitoring and Evaluation, RM&E) over the last several years, regional biologists have learned that juvenile salmon tend to:

- enter Cougar Reservoir mostly in March through May,
- be subject to high copepod infestation if they remain in the reservoir,
- survive reservoir and dam passage at low rates under current operations (<20%),
- exit Cougar Reservoir mostly at night;
- pass in higher numbers when the reservoir is lower in elevation (and fish can more easily find an outlet through the dam);
- survive at greater numbers when passed through the regulating outlets;

- and survive at a higher rate if they are smaller (< 160 mm) under some dam passage conditions.

Cougar Dam Operations

Cougar Dam is located on the South Fork McKenzie River, Oregon. Cougar Dam is a storage project with baseload power capabilities, meaning that outflows do not fluctuate; thus, there is no re-regulating project downstream of Cougar Dam. Cougar Dam has outlets at several different elevations in the reservoir, including the spillway (elevation 1,656.75 feet), turbines (elevation 1,419.5 feet), and regulating outlets (elevation 1,479 feet). Cougar Dam also has a Water Temperature Control Tower (WTCT) at the intake tower that allows for selective withdrawal of water from various elevations in the reservoir for downstream river temperature management. The upper portion of the WTCT has weirs that can be used to withdraw warmer surface water from the reservoir above elevation 1,571 feet. Operation of the WTCT provides discharge water temperatures conducive to Chinook salmon reproduction and rearing in the South Fork McKenzie River downstream from the dam.

Per the water control diagram (Figure 1), Cougar Reservoir fluctuates throughout the year from a minimum conservation pool (elevation 1,532 feet) in the winter to capture flood events, to a maximum conservation pool (elevation 1,690 feet) in the summer for summer reservoir recreation and downstream flow augmentation for fish, water quality, power generation, irrigation, and M&I uses as water is available for storage. Beginning 31-August, the Corps begins drawing the reservoir down in preparation for operating for flood risk management. The reservoir is typically drawn down to minimum conservation pool (elevation 1,532 feet) by 01-December for Major Flood Season operation for flood risk management. Conservation Storing Season begins 01-February and Cougar Reservoir is typically refilled to maximum conservation pool by 10-May according to the water control diagram (Figure 4); however, variability in climate (droughts/floods) can influence timing, particularly during refill.

Delayed Refill

The objective of this operation is to improve juvenile salmon passage through Cougar Reservoir and Dam. In most years, fry passage is low. Refill operations substantially reduce outflow and the downstream flow signal. A larger reservoir also creates longer transit times for downstream migrants. By holding the pool at a low elevation and creating a slight drawdown during juvenile migration, more fish can be passed during their early life stages.

Delaying refill will have an impact on the overall storage of Cougar Reservoir and there are concerns that water temperature management using the WTCT weirs could be impacted by the delayed refill operation. Cougar Reservoir must refill above 1571 ft. in order for the WTCT to be used. Operation of the WTCT is needed to allow the release of warmer surface water in the summer while providing cooler water during Chinook salmon spawning and incubation. Without WTCT operations, cooler water temperatures would be discharged downstream of Cougar Dam throughout the summer and warmer water temperatures throughout the fall. This

could lead to a delay in adult migration timing and collection, and the early emergence and/or mortality of incubating eggs in the reaches downstream of Cougar Dam.

The goal of delaying refill is to extend good juvenile passage conditions into the spring while ensuring sufficient summer storage to provide water temperature management in the late summer and fall. These are both important strategies for increasing the Chinook salmon abundance in the South Fork McKenzie River.

Analysis

Recognizing that the risk of extending the duration of drawdown to refill varies with the timing and magnitude of inflows to the reservoir, the Federal agencies' Internal Technical Team (ITT) conducted a time-series simulation of the operation, using inflows from water years 2000 through 2021. Pertinent findings from that analysis showed:

- In the first 15 years of this data set, the reservoir would refill to El. 1571 ft. when started by 01-May.
- In the more recent 7 years (2015 – 2021) however, refill to El. 1571 ft. would have not been possible 3 out of the 7 years if started on 01-May.
  - These years included 2015, 2016, and 2018.

- What do the difficult years have in common?
  - Adequate/Insufficient or Deficit Year (as defined in the 2008 RPA);
  - Snowpack is less than the median (24 inches) on April 01;
  - Average two-week inflows in either late March, early April or late April that are =/< 1,000 cfs AND average two-week inflows in early May (01-15 May) are < 900 cfs.

Cougar Refill Decision Strategy

To minimize the risk to temperature control, the expert panel has adopted the following strategy to assist the Federal agencies' Flow Management and Water Quality Team (FMWQT) in making real-time decisions regarding refill. These decisions will weigh current hydrology and outmigration timing, and the likelihood of achieving el 1571 by early summer. Refill is expected to be initiated later in cooler, wet years, and earlier in warmer, dry years. As information is collected through implementation of this operation, data will be used to refine the operation, and specifically the refill timing and target elevation range.

In general, inflows into Cougar Dam begin to decrease in May or June as rains taper off and summer dry weather patterns set in. In dry years, dry weather patterns typically establish themselves earlier in the year, whereas in wet years, rains may persist well into June. This is demonstrated by comparing 2011, an abundant water year, to 2021, an insufficient - deficit water year. In 2011, inflows into Cougar Reservoir for the month of June averaged 1,202 cfs or approximately 600 cfs over outflows (which typically range between 300 - 400 cfs), while 2021 inflows averaged 339 cfs or approximately 61 cfs under average outflow. Delaying the refill of

Cougar Reservoir until mid- May in 2011 would not have prevented refill to the WTCT weir (El. 1571 ft.) later that month, but such an operation in 2021 would have. Adaptive management and the use of short-term and seasonal inflow forecasts, modeling tools and real-time inflow and fish migration information will be critical to the implementation of a successful drawdown operation.

Constraints and Considerations

This plan should consider both the constraints that must not be violated, as well as other considerations such as current hydrologic conditions, and the ResSim modeling results described above. While implementing a spring fish passage operation at Cougar Dam the following constraints must be adhered to at all times:

a. Regulating outlet (RO) outflows of greater than 800 cfs are known to produce total dissolved gas (TDG) in exceedance of 110%. This should be monitored and avoided unless actively fighting a flood.
b. Normal drawdown and refill rates must be followed to protect embankments and the dam. This includes no greater than a 3ft/day drawdown or a 5ft/day refill rate.
c. The RO gates should not be opened less than their minimum gate opening restriction, which is 1.25 ft.
d. The Corps' flood control mission supersedes all other actions and at no time will human health or safety be jeopardized during the implementation of this measure.
e. At no time will the Cougar diversion tunnel be used to provide downstream flows or water temperature management.

In addition to the constraints, the following considerations were used to develop the Cougar Drawdown implementation plan:

a. Operating the ROs at elevations below 1495 ft. has some potential flow control issues (pressurizing and depressurizing the upstream portions). This type of flow condition is known to cause damage and should be avoided.
b. The Water Temperature Control Tower (WTC) can be operated to a minimum elevation of 1571 ft., which corresponds to about 76,000 acre-feet storage. Once the reservoir drops below this elevation, releases are only possible through the turbine (El. 1438.5 ft.) and RO outlets (El 1478.75 ft.).
c. The Cougar Adult Fish Facility is typically operated from mid-March through mid-October. Adult fish begin their upstream migration once water temperatures reach ~52°F. Temperature management operations should be conducted so that such water temperatures can be achieved at the onset of the normal migration window (June-July).
d. Larger RO gate openings provide safer passage and are more protective for fish.
e. Adult bull trout will likely be present in the reservoir during this operation, and some may pass through the ROs while they are in operation. While not certain of the level of impact, USFWS biologist suspect there will be some individual level impacts that otherwise may not have been incurred had those adult fish remained in the reservoir.

Implementation Plan

Taking the above information into account, the following implementation plan has been developed for a Delayed Refill operation at Cougar Dam:

1. Initiate refill to minimum conservation pool el 1532 on December 16.
2. Hold the reservoir to El. 1532 ft. until 01-March.
3. On 01-March, begin to draft Cougar Reservoir to El. 1520 ft., targeting this elevation on 01-April. The intent is to provide an increased downstream flow signal that encourages outmigration of fish from the reservoir.
4. From December 16 through June 1, prioritize the ROs at night when passage is highest. Generate during the day. Note: additional powerhouse discharges may be required depending on rain events, inflow conditions, or downstream water quality values.
5. Delay refill from 1520 ft. as long as possible, while maintaining a high likelihood of reaching El. 1571 ft. by July 1. Use adaptive management to determine the refill starting date. The decision on when to initiate refill will be made by the Federal agencies' Flow and Water Quality Management Team (FWQMT) considering April and May hydrologic data including snowpack, average weekly inflows, and extended Water Supply forecasts from the Northwest River Forecast Center, and fish migration data. The following conditions will guide in-season management of refill.
    a. In years that are obviously dry (low snowpack, low inflows) on 01-April and the long-term NOAA climate forecast suggests a dry spring and summer, begin refill on 15-April.
    b. In Adequate/Abundant years (with high inflows in March and April combined with a large snowpack), begin the delayed refill on 15-May.
    c. For all lower snowpack, moderate to low inflow years, start refill no later than 01-May.
    d. Juvenile Chinook salmon counts (e.g. from screw trapping) upstream of and downstream from Cougar Dam will also inform refill operations..
    e. Achieving El 1571 ft. by July 1 is a higher priority than maintaining the 400-cfs June minimum flow. If hydrologic conditions change, the FWQMT can recommend reducing discharge levels to achieve El 1571 ft. by July 1.
6. Once El. 1571 ft. is reached, hold the reservoir at this elevation for as long as possible, while maintaining the minimum 300 cfs throughout the summer unless experiencing drought conditions. Adaptive management will be necessary with continual coordination with the Federal agencies' Flow and Water Quality Management Team (FMWQT).
7. In September, increase up to 700 cfs to begin drawing down Cougar Reservoir.

8. Beginning on 15-October, release flows as needed to achieve the 1505' elevation for Cougar Deep Drawdown operations by November 15 or earlier, as specified in the Injunction Measure 14 Implementation Plan.

Biological Monitoring

The objective of this RM&E is to learn as much as possible from the 2022 downstream fish passage operation to inform not only this coming year's operation, but future operations as well; and to provide information to guide adaptive management within and between years. In order to meet requirements of the Court Order to provide meaningful and specific RM&E for interim measures (Interim Injunction, paragraphs 2 & 4), the following outline the metrics that can be evaluated this spring during the delayed refill operations.

The metrics of interest include spring Chinook juvenile passage timing, size at passage, passage rates and passage survival. A focus of the delayed refill and lower reservoir elevation is to facilitate passage for Chinook salmon fry, but yearling fish are also present and should benefit from these operations.

The primary approach will be to operate rotary screw traps in the South Fork McKenzie above the reservoir and downstream from the dam in the turbine and RO channels throughout this operation. The minimum RM&E to evaluate passage effectiveness of this operation for fry will be timing and size of Chinook salmon migrants.

Trap efficiency tests will be conducted for the range of operating conditions and the size range of fish captured in the trap to allow for expansion of catch. Note that Romer et al. (2017) reported the recapture numbers above the reservoir during efficiency tests were high enough from mid-March through mid-May to provide weekly estimates. Trap efficiency tests downstream of Cougar Dam may require releases of surrogate hatchery fish if sample size of fish caught in the traps is too small for tests. Timing and size of fry will be compared between the upstream and downstream traps as an index of passage effectiveness. Expanded catch will also provide an index of survival.

Data collected from captured fish would include numbers, size (measured fork length of a representative sample of sizes), and condition of fish noting injuries or physical conditions such as de-scaling or loss of protective mucous. Holding mortality should be assessed at the downstream traps. Tissue samples from Chinook fry caught in the upstream trap will be collected and catalogued to provide a brood year reference collection for evaluating productivity of outplanted adult fish as part of a pedigree analysis. A specific sampling plan will be developed by December 31, 2021 to determine sample size and sampling intensity after consultation with geneticists and review of catch data from previous years.

Chinook salmon caught in the upstream trap before April that are >80–90 mm would likely be yearling migrants that had reared in South Fork McKenzie. Yearlings captured in the upstream trap will be tagged with PIT tags. Scales will be collected and catalogued to provide a brood

year reference collection for identifying stream-reared yearlings in returning adult salmon. Chinook salmon caught in the downstream trap will be scanned for PIT tags and data will be recorded on recaptured fish including fish length, date, and location.

Monitoring of downstream temperatures and TDG are available currently and could be extended to lower reaches of the South Fork McKenzie, if necessary.

A long-term RM&E Plan is currently being developed and will be submitted to the Court in the winter of 2021/2022. This plan will include additional RM&E specific to monitoring the success of this operation.

Dam Safety Considerations

During previous deep drawdowns (to elevations deeper than the proposed minimum elevation of 1520 ft. for this operation), a temporary increased rate of settlement occurred. The mechanism for this increased settlement rate is being evaluated currently but deep drawdowns could potentially increase the likelihood of potential failure modes for the dam. Drafting the reservoir from El 1532 to elevation 1520 ft and holding, is not expected to increase dam safety related risk. A monitoring plan was developed for the Nov 15, 2021 to Dec 15, 2021 drawdown to El 1505 ft. to confirm that no dam safety concerns are identified through visual inspections, surveying measurements and instrumentation. The results of the monitoring for the drawdown operation will be used to determine what specific monitoring, if any, would be required for holding the reservoir at El 1520 ft. for this delayed refill operation.

Corps engineers recommend maintaining pressurized flow in the regulating conduit during this operation. With the 12.5-foot full gate opening on the Cougar ROs and an invert elevation of 1478.5 ft., MSL, the ROs should not be operated if the water surface elevation drops below 1499.5 ft., MSL. While there is no intention to operate below 1500 ft., maximum gate openings that should be maintained below 1500 ft. are listed in Table 1 below.

Table 1. Recommended Maximum Gate Openings for Specified Low Reservoir Elevations, in feet

Reservoir Elevation (ft)	Maximum Gate Opening (ft)
1495	9.8
1494	9.2
1493	8.6
1492	8.0
1491	7.4
1490	6.8
1489	6.2
1488	5.6
1487	5.0
1486	4.4
1485	3.8
1484	3.2
1483	2.6
1482	2.0
1481	1.4

Irrigation

There is approximately 2,100 acre-feet of storage water currently under contract for irrigation use downstream of Blue River Dam and Cougar Dam, with water contracts for diversions at various locations along the McKenzie River. Irrigation water users can divert up to the 2,100 acre-feet of storage water during the irrigation season from April 1 – October 31. Actions that substantially reduce summer storage or releases could affect irrigation water service contractors and water rights.

Power Impacts

Keeping the reservoir at about minimum conservation pool and prioritizing the RO at night from about February 1 through March 1, and then continuing to prioritize the RO at night during the draft to 1520' by April 1 until refill begins later in April, or in May will result in a significant reduction of electrical production at Cougar Dam in the later winter and spring. The generation impacts will be quantified after implementation or future RES-SIM/HYDSIM modeling.

Transmission Considerations

Reduced generation during the spring drawdown operation and prioritizing the regulating outlets in the evenings is not expected to have significant impacts to the transmission system.

References

Romer, J.D., Monzyk, F.R., Emig, R. and Friesen, T.A., 2017. Juvenile salmonid outmigration monitoring at Willamette Valley Project reservoirs. *Annual Report of Oregon Department of Fish and Wildlife (ODFW) to US Army Corps of Engineers, Portland, Oregon*.

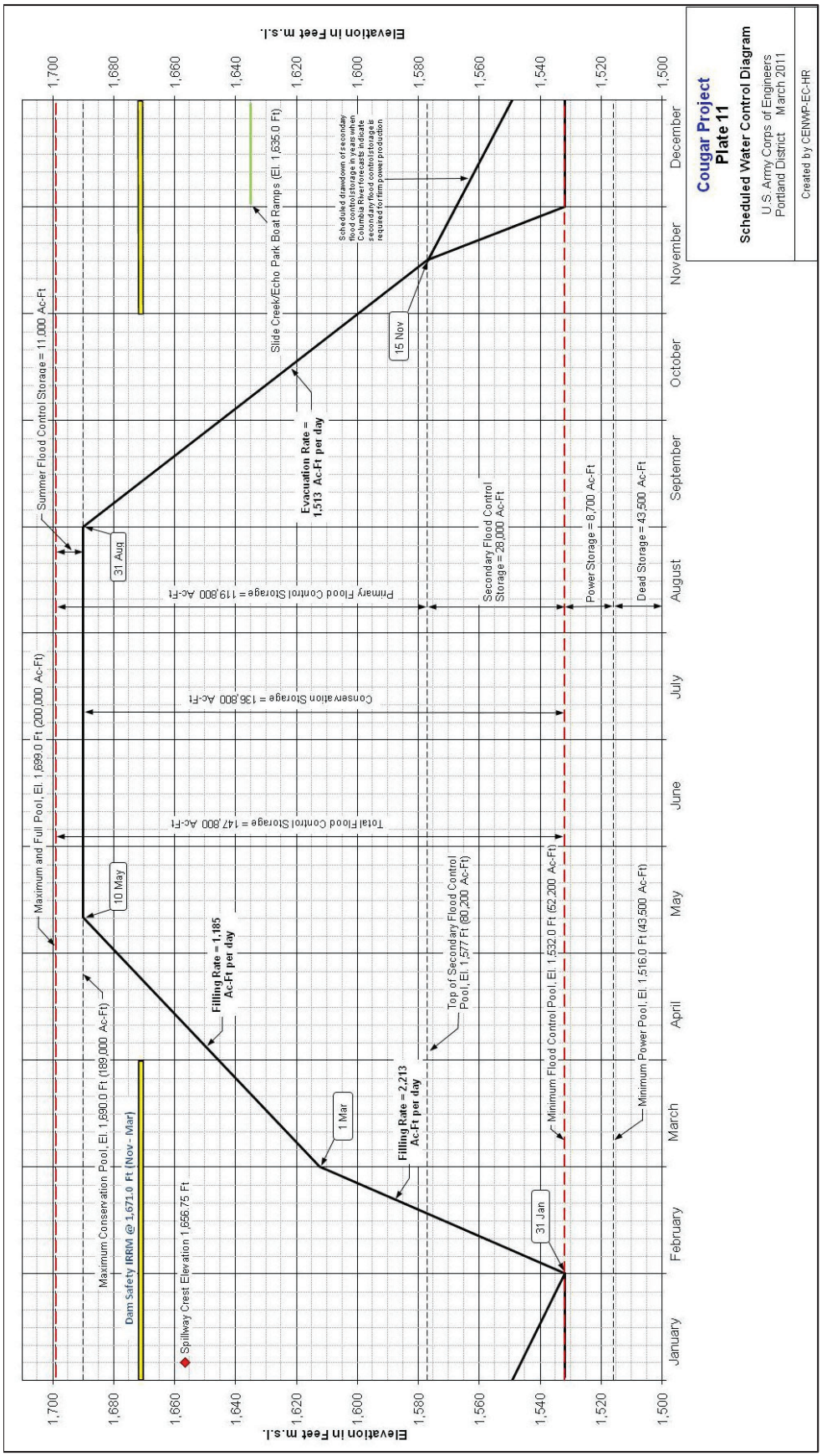

Figure 1. Cougar Reservoir Water Control Diagram

ATTACHMENT 3

Fall Creek Dam and Reservoir Delayed Refill
2021-10-15

Description/Intent

On September 1, 2021, the U.S. District Court for the District of Oregon issued an Injunction Order that directs the Corps to implement specified operations intended to improve conditions for fish passage and water quality in the Willamette Valley Project (WVP) to avoid irreparable harm to Endangered Species Act (ESA) - listed salmonids during the interim period until the completion of the reinitiated ESA consultation. These measures must be carried out "to the greatest extent practicable under existing hydrologic conditions and necessary flood control operations" while making "every effort to comply with the various water temperature, Total Dissolved Gas (TDG) and instream flow requirements governing WVP."

The Court assigned an Expert Panel comprised of two of Plaintiffs' experts, two NMFS biologists, two Corps employees, and two "ad hoc" Federal experts to define the details of this and other measures. Expert Panel assignments include "implementation plans for winter and spring fish-passage operations …" at Fall Creek Dam and reservoir.

The Expert Panel has considered multiple factors in developing this implementation plan.

- First, what are the biological objectives being sought and how can these objectives best be achieved?
- Second, what are the constraints or factors that need to be considered?
- And third, what additional information should be considered when shaping the operation?

Biological Objectives

Current operations at Fall Creek Dam include an annual drawdown to the regulating outlet invert at the base of the dam (elevation 670 ft.), draining the reservoir and providing riverine conditions to the dam where the water and migrating fish pass through the regulating outlet. This measure has proven highly successful in passing juvenile fish that have spent most of a year in the reservoir and its watershed. However, pedigree analysis to date suggests a low cohort replacement rate and low effective number of breeders for adult Chinook salmon passed upstream of the dam based on returns of age 3 and age 4 adults (O'Malley and Bohn 2018).

The natural behaviors of juvenile UW Chinook salmon vary widely, with ocean entry as little as three months from emergence, to residence between their natal tributaries and the Columbia River estuary for a year or more. Data available specific to Chinook salmon juveniles in the Fall Creek drainage show large numbers of juveniles entering the reservoir throughout the late winter and spring, peaking in February and March. Juveniles that enter in the summer and fall grow rapidly in the reservoir and pass the dam as it is being drawn down in the fall, or while the reservoir is drawn down.

The primary objective of this measure is to provide safe and timely passage for young-of-year juvenile Chinook salmon that enter Fall Creek reservoir such that they may avoid extended reservoir residence and express their natural life-history strategy.

Other objectives include:

- maintaining sufficient flow to operate the adult fish trap located immediately below the dam (100 cfs) from mid-April through October 1.
- meeting BiOp Fall Creek flow objectives

The Expert Panel considered a number of factors in developing this plan to meet these objectives.

- Juvenile Chinook salmon enter the reservoir in large numbers in the winter and early spring.
  - under current operations, those fish would either have to dive to find the operating intake or remain in the reservoir until the fall drawdown.
  - reservoir residence may reduce cohort survival from factors such as copepod infestation, but surviving fish that remain in the reservoir have high growth rates.
- Past deep drawdowns have liberated substantial volumes of sediment stored in Fall Creek reservoir causing channel aggradation and other effects on channel morphometry downstream from the dam.
- Flood damage reduction and sediment management operations may necessitate variations in storage and discharge.
- As Fall Creek reservoir has historically been used to augment summer flows to meet downstream demands, modifying operations in a manner that reduces the stored water available for this purpose may be mitigated through changes in the operations at other projects.
- There is some risk that exposing the dam face throughout the winter could cause erosion. Should dam safety issues emerge, measures adopted here may be foregone as needed.

Implementation Plan

This implementation plan adopts and extends the current deep drawdown program. Available data indicates that the vast majority of juvenile Chinook salmon enter and pass the reservoir in the spring.

1. Operate dam intake gates in a manner that maximizes fish passage survival at all times.

2. Maintain sufficient discharge to effectively operate the adult trap from April 15 through September 30. [1]
3. Extend the fall deep drawdown with the reservoir at or near the regulating invert (El. ~670-680 ft.) from 01-December through 15-January except as needed to provide downstream flood damage reduction.
4. In the first year, on 16-January, initiate reservoir refill to El. 700 ft. and hold until March 15 except as needed to provide downstream flood damage reduction or sediment management. [2] This will ensure that a screw trap can be deployed downstream of Fall Creek Dam for continuous biological monitoring throughout the winter/spring operation.
    a. Screwtrap operators will monitor and document sediment levels that lead to disruptions in trap operation. In-season and future year adaptive management will be used based on realtime conditions and information learned from past study (USGS, in draft).
    b. In follow-on years, the reservoir may be held at lower elevations for longer periods of time and once more information has been collected.
5. March 16, initiate refill to reach El. 728 ft. by April 15.
6. April 16 through May 15 refill to and maintain El. 728 ft unless dry weather persists, and additional refill is necessary to ensure operation of the adult trap through September 30. Adaptive management will be necessary.
7. After May 15, maintain sufficient discharge to operate the adult trap while refilling the reservoir to the extent possible.
8. Blend releases through the various horns to control downstream water temperatures.
9. Manage stored water to ensure a high probability of being able to operate the adult trap through September 30.

It is expected that well in excess of 50%, perhaps as much as 90%, of the annual run of juvenile Chinook salmon that enter Fall Creek reservoir will be passed through Fall Creek Dam without prolonged reservoir residence under this operation. The relatively small numbers of juvenile salmon arriving later than May 15 would either have to sound to find the operating intake to pass the dam, or remain in the reservoir until the fall drawdown.

Research, Monitoring, & Evaluation

The goal of the RM&E is to learn as much as possible from the Fall Creek downstream fish passage operation to evaluate the success of this operation and to identify changes/adjustments to the operation in future years. The metrics of interest include juvenile Chinook salmon passage timing with an emphasis on fry. Metrics such as passage survival and contribution to adult returns will be long-term. Other metrics such as forebay behavior (once

[1] In low water years continuous trap operation may not be possible. In such instances water management and trap operation would be coordinated to minimize adult passage delay.

[2] The Corps may need to provide flushing flows to clear the tailrace.

the reservoir is raised to 728 and higher) and distribution, and route distribution may not be directly measured for fry migrants but techniques such as sonar could be used to investigate behavior. In order to meet requirements of the Court Order to provide meaningful and specific RM&E for interim measures (Interim Injunction, paragraphs 2 & 4), the following outlines the metrics that can be evaluated this spring during extended drawdown operations.

The objective of the winter-spring operations at Fall Creek Dam and reservoir is to create favorable passage conditions for juvenile Chinook salmon. Because most of the large smolts and holdover Chinook salmon will likely leave during the fall/early winter drawdown, the late winter /spring drawdown is designed to allow for volitional passage of Chinook salmon fry during their early dispersal stage.

Evaluation of the effectiveness of the passage measures will incorporate trapping juvenile salmon entering the reservoir and trapping downstream of the dam. Rotary screw traps will be deployed and operated in Fall Creek above the reservoir and downstream of the dam. Methods will follow past trap operations, including estimation of trap efficiencies (Keefer et al. 2012).

The minimum RM&E to evaluate passage effectiveness of this operation on fry will be timing and size of Chinook salmon migrants. Trap efficiency tests will be conducted at the upstream and downstream trap to provide estimates of the total number of migrants captured in each trap, with an emphasis on Chinook fry. Timing and size of fry will be compared between the upstream and downstream traps as an index of passage effectiveness. Expanded catch will also provide an index of survival.

Data collected from captured fish would include numbers, size (measure fork length of a representative sample of sizes), and condition of fish noting injuries or physical conditions such as de-scaling or loss of protective mucous.

Tissue samples will be collected from fry across the migration period. Samples will be catalogued along with appropriate data such as date, size of fish, and location (upstream or downstream trap). Sample size needed for analysis will be determined by December 31, 2021 after consultation with geneticist and review of previous trap catch relative to the number of outplanted adult fish.

Chinook salmon caught in January 16–March at either the upstream or downstream trap that are >80–90 mm would likely be yearling migrants that had reared in Fall Creek, assuming most of the resident reservoir-reared fish would have migrated during the deep drawdown. Scales from these fish will be collected and catalogued to provide reference for stream-reared yearlings. Yearling Chinook captured in January to mid-April at the upstream trap, will be tagged with PIT tags to provide information on migratory behavior of yearling fish during the winter-spring operations. Larger Chinook salmon captured in the downstream trap will be scanned for tags and data will be recorded on date and size of recaptured fish.

Irrigation

There is approximately 11.5 acre-feet of storage water currently under contract for irrigation use downstream of Fall Creek Dam with water being diverted from various locations along Fall Creek. Irrigation water users can divert up to the 11.5 acre-feet of storage water during the irrigation season from April 1 – October 31. Actions that substantially reduce summer storage or releases could affect irrigation water service contractors and water rights.

Hydropower Impacts

None; Fall Creek does not produce hydropower.

Transmission Impacts

None; Fall Creek does not produce hydropower.

References

O'Malley, K.G., and Bohn, S. 2018. Genetic parentage analysis of Fall Creek spring Chinook salmon: an evaluation of return timing and functional gene diversity. Prepared for U.S. Army Corps of Engineers, Portland District.

U.S. Geological Survey (USGS). Geographic Response to Fall Creek Lake Drawdowns (in draft). https://www.usgs.gov/centers/or-water/science/geomorphic-response-fall-creek-lake-drawdowns?qt-science_center_objects=0#qt-science_center_objects